



Creating African Leadership in Artificial Intelligence

Outcomes of the IndabaX 2018

July 2018

The
**Deep Learning
Indaba**

Creating African Leadership in Artificial Intelligence: Outcomes of the IndabaX 2018

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This report can be viewed online at deeplearningindaba.com/reports

A Personal Message

Our mission to *Strengthen African Machine Learning* has given us the privilege of engaging with some of the most energetic of African citizens: all who share our vision of seeing Africans as owners and shapers of the ongoing advances in Machine Learning and Artificial Intelligence. Yet, it would not have been inaccurate, even a few months ago, to describe the state of African AI and its leaderships as sparse, scattered, or existing in pockets. But we believe, through our work with the IndabaX, which this report describes, that this is no longer the case. The IndabaX represents some of our most impactful work as an organisation thus far, and its outcomes have made us immensely proud.

'The central cultural fact of African life', as Anthony Appiah famously says, 'is not in its sameness, but in its enormous diversity'. The IndabaX, by creating and supporting local leadership in individual countries, sought to celebrate this diversity. The IndabaX events were meant as incubators for local ideas and solutions that accommodated the varying levels of experience and motivations, and the different modes of communication and understanding across countries. Yet, we also saw the IndabaX as a way to create a new type of pan-African unity, one created through a shared commitment to science and technology, using machine learning and artificial intelligence and the opportunities it holds for the advancement of our continent.

We hope, like the annual Indaba, that the IndabaX events will also become a regular fixture within the African AI calendar, and we work towards making this a reality. We are humbled by the leaders who passionately and selflessly push African AI forward, and who made the IndabaX events such a success; this report is dedicated to them.

*The Indaba Abantu,
June 2018*

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1. Introduction

The principal recommendation of the first Deep Learning Indaba held in September 2017 was to widen African participation. Quoting from the Indaba annual report¹: 'pan-African participation remains a core value of the Indaba and is essential for creating a fluid, united and wholly-inclusive African Machine Learning community'. Widening pan-African participation in this context was meant in the most general sense possible, and it was as a means of addressing this recommendation that the IndabaX programme was borne.

An IndabaX is a locally-organised, one-day Indaba that helps spread knowledge and builds capacity in machine learning.

The IndabaX is a means with which to experiment with the ways in which we strengthen African Machine Learning and allow more people to contribute to the conversation around machine learning and artificial intelligence.

During the 2017 Indaba, which was meant as the first of an annual gathering of the African AI community, the Indaba hosted over 300 people coming from 23 African countries and 33 African research institutions. But the Indaba received over 700 applications, which meant that for every person that was able to attend, there was another who could not be accommodated. Far greater reach could be had by stimulating similar Indaba-like events within individual countries across

our continent. The IndabaX was also a way to maintain the momentum and excitement generated by the first Indaba.

These IndabaX events in 2018 were co-ordinated across 13 countries within a two week period - the last week in April and the first week of May 2018. These **13 host countries were Algeria, Botswana, Cameroon, Kenya, Lesotho, Namibia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe**. This period also coincided with the closing of our applications for the next annual Indaba, which also served the role of creating awareness of the annual Indaba: at the close of applications for the annual Indaba, we received almost 1300 applications, from 35 African countries and 72 countries globally.

This first round of IndabaX events was a resounding success and met its objectives: it led to the creation of African leadership in the field of machine learning within countries across the continent, created opportunities for exposure to local speakers, and included more people in the conversation around machine learning and AI. By the end of the IndabaX events, just over 1000 people were involved in teaching, learning and debate about African opportunities in AI.

¹ 'Strengthening African Machine Learning: Outcomes of the first Deep Learning Indaba', November 2017, Indaba Organisation. deeplearningindaba.com/reports



University of Tlemcen, Faculty of Technology
Biomedical Engineering Department

Deep Learning IndabaXAlgeria

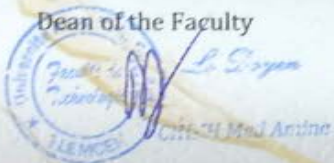
ATTENDANCE CERTIFICATE

This is to certify that

Mohammed El Amine Bechar

Has successfully achieved a one-day training in Deep Learning jointly organized by the University of Tlemcen, Algeria and the University of Mons, Belgium, in Tlemcen on April 9th, 2018.

Dean of the Faculty



Dr Sidi Ahmed MAHMOUDI



Dr Mostafa EL HABIB DAHO



2. Recommendations

1. Strengthen Participation of Women

The participation of women in the IndabaX events was generally low, and sustained effort to significantly increase the levels of participation of women is critically needed. Going forward, this should be addressed in several ways, through: sustained emphasis amongst organisers of the importance of diversity within the Indaba's mission, supporting participation targets, and the creation of new Indaba Organisation programmes specifically supporting *African Women in Machine Learning*.

2. Support More Countries

The thirst for community building and creating leadership means that an important recommendation for future IndabaX events is to expand the number of countries that are included. Since the conclusion of the IndabaX events, we have had discussions about IndabaX events with communities and leaders in several countries beyond the thirteen from 2018, e.g., Nigeria, Burundi, Tunisia, and Mozambique. Expansion in this way will require a significantly expanded financial strategy and will be an ongoing challenge for the future of the IndabaX.

3. Reduce Barriers due to Language

Expansion to a wider cohort of countries is coupled with the importance of reducing barriers to entry due to language. There was an acute need for greater inclusion of countries in which French (and languages other than English) was the interlanguage (i.e. lingua franca). The diversity of language

across our continent means that we will better serve the need for continental ownership and the shaping of technological advances through a commitment to knowledge-sharing in a multitude of languages.

4. Access to International Speakers

We should support the IndabaX events more strongly through access to international leaders in the field and external speakers. Most 2018 events reported that this was a significant contributor to the learning environment and encouraged greater interest, drove up applications, and increased participation.

5. More Flexible Time-frames

The IndabaX should move towards more flexible timings, potentially allowing IndabaX events throughout the year. This flexibility will allow more time to ensure the completion of the international funds-transfer, maintain the constancy of activity across the continent, and to reduce pressures on local leaders and organising teams.

6. Feedback to Policy-makers

Policy-makers must be made a more integral part of the IndabaX events. This provides a natural way to allow policy-makers to better understand the challenges of local research and innovation communities, and to gain an additional source of insight into the design of local strategies and policy needed for societies that benefit from advanced machine learning and AI.

3. Creating Local Leadership in AI

The Indaba has a mission to strengthen African machine learning. This mission involves two pillars: to ensure that we as Africans are owners and shapers of the ongoing advances in AI, and to contribute to greater diversity in these fields of science and technology. We quickly realised that driving this mission through a one-week annual gathering would not be enough to achieve this mission. Instead, this could only be achieved by ensuring that local leaders are identified and expertise spread across African countries, and that the needed conversations around AI are driven by these local leaders and practitioners.

The IndabaX events were created to fulfil exactly this need by creating an opportunity for local leaders to come forward, and to further stimulate their practitioner communities to come together. We created a call for applications, open to groups from any country across our continent, asking for short proposals (up to 3 pages) in which organising teams described their reasons for wanting to host an IndabaX event in their country. This type of call put the onus on leaders themselves to self-organise, come forward, but most importantly, to drive a programme that suits the specific needs of people in their country.

In their proposals, we asked organisers to answer several questions:

- Their reasons for wanting to organise an IndabaX and what outcomes they hoped to achieve.

- Their plans to ensure diversity and inclusion in participants and speakers. Our aim was to conscientise organisers and to encourage all groups to be more mindful of the need for greater diversity in organisers, speakers and participants; one of the Indaba's core principles.
- The format the Indaba would take with a rough schedule for the day, and what number of attendees would be planned for. An IndabaX did not need to be big, it could be 10 people or 100 people - anything that helped strengthen each local machine learning community.
- Details of the support needed. We encouraged groups to be self-sufficient and seek out external funding to support their activities. If they needed financial support from us, we asked for a short budget.

The principle that the IndabaX working group took was to support as many IndabaX applications as possible (if not all), given the constraints of the budget that we had. We received 16 applications, of which 1 was incomplete and not relevant to the call, and three groups in a region close to each other in South Africa were asked to merge, resulting in 13 IndabaX events for 2018.

We believe creating and supporting the IndabaX is amongst the most impactful work we have done thus far, since it genuinely created new communities, and gave exposure to people who would not otherwise have been heard or have been able to contribute. In total, 1002 Africans were included in the conversation around

AI. Figure 1 shows each of the 13 countries and some of their participation statistics. Further details appear in the specific country reviews in section 5.

One of the ongoing challenges is the participation of women across the events, which is shown in the percentage bar associated with each country in

figure 1. The IndabaXKenya stands out with excellent representation, attributed to being driven by a community of female leaders. There is much to do here, but being able to report these initial participation statistics provides a reference point with which to improve future generations of IndabaX events.

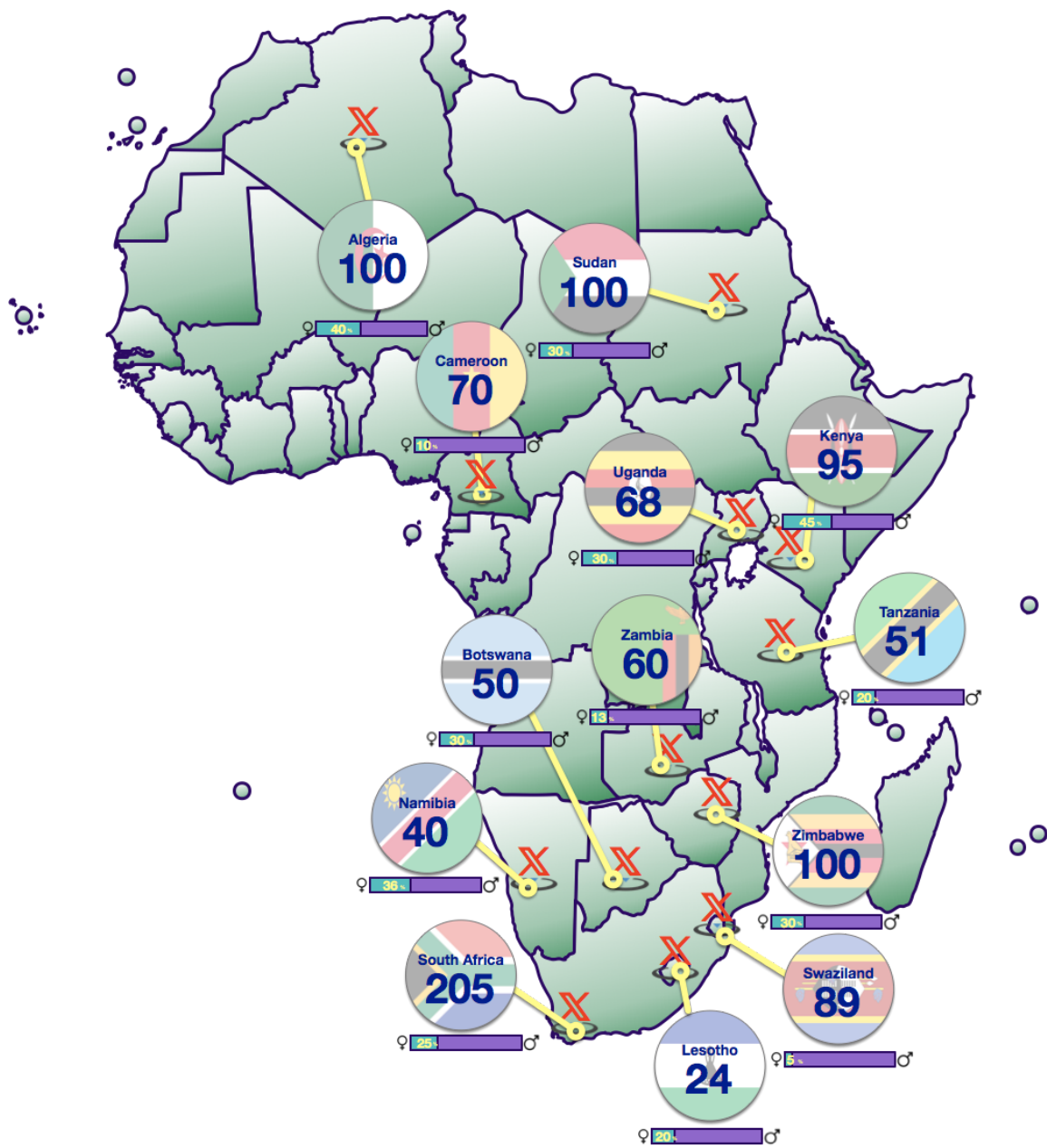
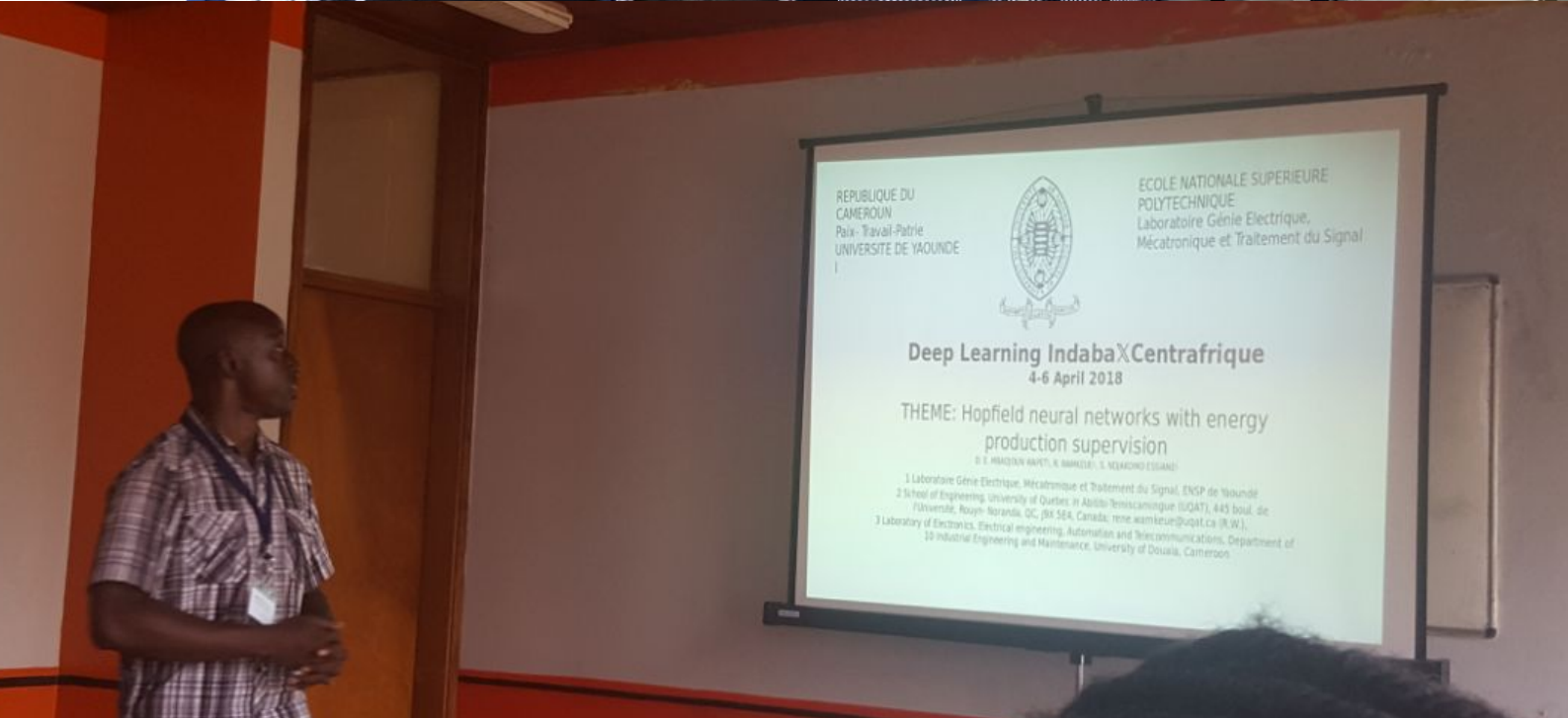


Figure 1: Attendance at the 2018 IndabaX events, with a total of 1002 attendees. Circles indicate the number of attendees for each country, and the bars below indicate the percentage of attendees that were women.





“ Everyone really welcomed the platform to engage in ML and AI.



4. Financing the IndabaX

The funding for the IndabaX2018 came from the remaining funds that were raised for the first Indaba in 2017. This was a total amount of ZAR 250,000, which was divided according to the requests made by each of the individual IndabaX events. The amounts we disbursed to each of these events is listed in the table below for the twelve of the events; the thirteenth IndabaX, the IndabaXAlgeria was accepted as a late application by which time had already allocated all our funds and were not able to support that IndabaX financially.

There were two factors to that contributed greatly to the success of the IndabaX programme. The funding we received from the sponsors of the 2017 Indaba are one of these critical enablers of our programme; especially those that were entrusted to us as unrestricted gifts. **We are immensely grateful to the support of every one of our sponsors** and for their support towards creating African leadership in AI.

The University of the Witwatersrand was indispensable to our work, and

never hesitated to demonstrate their commitment to enabling knowledge transfer across the continent. We managed our finances and disbursement from a central project account that we used with the assistance of the Wits University. Without the University's continued support of our mission and to strengthening African machine learning, the IndabaX events would not have been possible.

Our biggest challenge was managing the disbursement of funds across different countries, institutions and groups. Fully complying with the needs of the project accounts to ensure correct transfer and navigating the different legal and financial compliance across regions proved to be a significant challenge and slowed our process down greatly. There is a clear need for greater time flexibility, suggesting that we should adjust the time frames at which the IndabaX events run to ensure that local organisers are given as much time as possible to ensure that funds can be transferred efficiently.

Table 1: Amounts allocated to each of the IndabaX 2018 events (in ZAR).

1	IndabaXZambia	R24,000	7	IndabaXSwaziland	R15,000
2	IndabaXUganda	R24,000	8	IndabaXNamibia	R14,000
3	IndabaXTanzania	R23,000	9	IndabaXBotswana	R23,000
4	IndabaXKenya	R27,000	10	IndabaXLesotho	R7,000
5	IndabaXSudan	R24,000	11	IndabaXCentrafrique	R25,000
6	IndabaXZimbabwe	R20,000	12	IndabaXWesternCape	R24,000

5. Thirteen IndabaX Gatherings

5.1 IndabaXAlgeria

IndabaXAlgeria was a day of lectures, discussion and workshops to inspire the Algerian machine learning community. The IndabaX was held with the support of the Faculty of Technology at the University of Tlemcen. Their sessions, which included both lectures and practicals, focused on introducing the attendees to deep learning as well as the use of high performance computing and cloud resources for deep learning. With an attendance of 100, women were well represented making up 40% of the total.

Of importance is the inclusion of homegrown expertise that shows the strength of the existing community. Two speakers specifically embodied this strength: Mostafa El Habib Daho and Sidi Ahmed Mahmoudi, both of whom received research degrees at the University of Tlemcen, and who were well received by attendees. Mostafa is now a research fellow and assistant professor at the same institution while Sidi is a PhD research associate at the University of Mons, Belgium.

Figure 2 shows the composition of attendees at the IndabaXAlgeria. This shows a strong culture of research and healthy pipeline that as they grow should see the inclusion of those groups from industry and startups that were absent for the 2018 IndabaX. A session on deep learning and the cloud was one of the most popular sessions, as well as the practical training session on object recognition. The organisers' future ambitions are to expand the Indaba to a

3 day meeting with a richer set of training sessions and tutorials. This Indaba did unfortunately not receive any funding from the Indaba organisation this year due to a late-stage accepted application; further funding would have specifically enabled more speakers to attend and in future event to realise the ambition of a multi-day event.

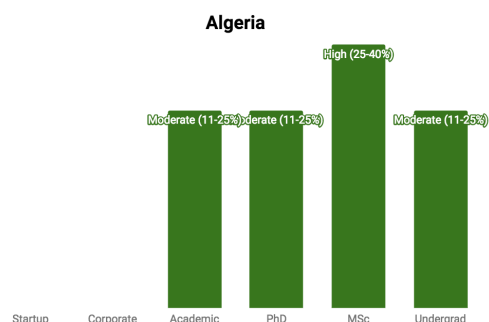


Figure 2: Algeria Participant types

5.2 IndabaXBotswana

The IndabaXBotswana event took place over two days; the first, a full day of lectures, followed by a full day of practical sessions. This was held with the support of two universities, the University of Botswana (UB) and Botswana International University of Science and Technology (BIUST). The goal was to raise awareness about machine learning, especially deep learning, and provide a forum for discussions related to strengthening machine learning in Botswana and Africa.

With 50 attendees, 30 percent were female. It is interesting to note that 9 individuals on their organising committee attended the First Deep Learning Indaba in 2017. Speakers like Dr. George Anderson whose sessions covered



“ We can strengthen ML in Africa by exposing more the ongoing work on the continent.



“The training sessions were most popular. They gave participants a more general view of why machine learning is important.”



“



machine learning, perceptrons, regression as well as facilitated several labs, made sure their material was simple enough for beginner level attendees to follow and learn.

Figure 3 shows the composition of attendees at this Indaba. The discussion on strengthening African machine learning was in-depth and highly rated. Msc and PhD students are not funded by government in Botswana, so this is clearly shown in the participation levels of the Indaba of these groups, and many leave for other countries.

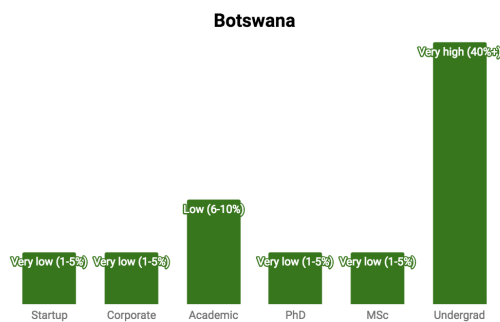


Figure 3: Botswana Participant types

Participants felt that there was a need to expand the degree programmes in computer science that are available to help bridge the gap between Botswana and other countries in machine learning. These degree programmes must focus on computational thinking in every part of the degrees and early exposure to programming and algorithmic thinking.

The need to break down silos between engineering, computing, students, and industry was identified as a clear need best summarised by the organisers: “we need to aggregate our voices”. This should be coupled with a greater level of regular activities, and there is a great deal of excitement and energy amongst students to see this happen. In addition, wider participation much be encouraged

from all sectors: more practitioners from industry should give talks at universities; students should be encouraged to do internships; inter-university competitions can be organised to strengthen the community. The importance of data and access to data was also an important topic.

5.3 IndabaX Centrafrique

This IndabaX was held in Cameroon and made an important commitment to strengthening machine learning in parts of our continent where French is used as a common language. The gathering was a 3-day event that attracted a diverse group of attendees, many of whom travelled from outside Yaounde. The attendees, mainly Masters and PhD students, were treated to a high quality event with both local and international speakers from Ecole Nationale Supérieure Polytechnique de Yaoundé, the Square Kilometer Array, Amazon Web Services and the University of the Witwatersrand, some of whom joined in remotely. Each topical presentation was accompanied by a practical to give participants hands on experience.

Figure 4 shows the proportion of different types of participants that attended. The overwhelming response from attendees was to continue to have similar gatherings as it is not common to have like-minded individuals brought together in this manner. The need for government involvement was also brought up, especially with regards to funding research as many researchers have to self-fund their work or depend on external support which is not always sustainable.

As this was the only IndabaX hosted in West Africa, there was considerable

interest expressed from neighbouring West and Central African countries but limited funds and facilities put a cap on the number of people that could be accommodated.

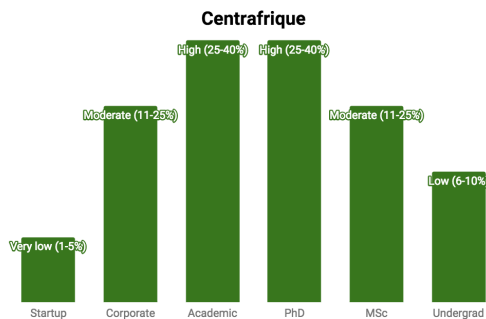


Figure 4: Centrafrique Participant types

5.4 IndabaX Lesotho

The University of Lesotho hosted this IndabaX to discuss the opportunities for machine learning and better data for solving practical problems. The one day event constituted a series of workshops around the theme of how data can be integrated into ongoing student projects. The most remarkable session, presented by Dr. Makhamsa Senekane, focused on ethics and privacy in data science while also urging for better gender representation in the development of artificial intelligence solutions as already existing biases can very easily become embedded into models if conscious effort is not put into incorporating different points of view.

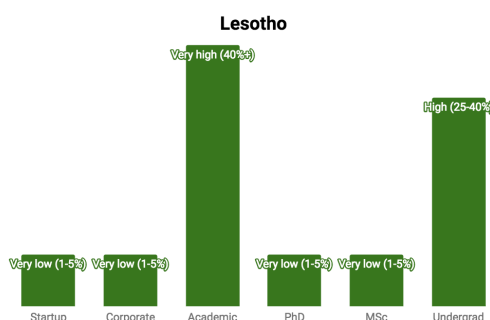


Figure 5: Lesotho Participant types

The sessions were mainly topical presentations with no practical ones, something which was highlighted as a possible improvement for a future IndabaX. One other interesting suggestion to strengthen machine learning was lobbying Mobile Network Operators to waive data costs on learning sites like Coursera so as to encourage technical upskilling.

5.5 IndabaX Kenya

Hosted by the Busara Centre for Behavioural Economics, the IndabaX Kenya agenda included a panel discussion on various artificial intelligence drivers and forces at play, a practical session that saw participants develop a system to learn entity embeddings of categorical variables and a poster session where machine learning research and projects were presented.

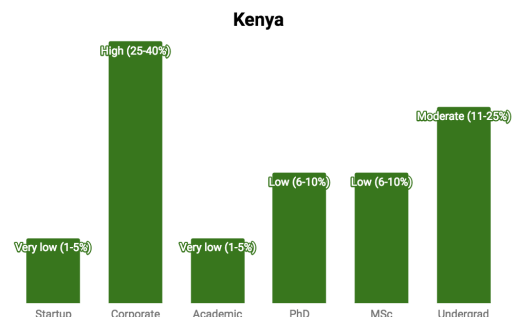


Figure 6: Kenya Participant types

Most outstanding of these was the panel discussion that involved stakeholders from government, academia and industry, as it highlighted practical and local use cases for artificial intelligence. The event also attracted delegates from neighbouring Tanzania, who presented their work during the poster session and went on to win the prize. The solution, Dr. Elsa, is an AI-backed health and telemedicine service that is offered for





free in Tanzania to empower doctors to make smarter and more informed decisions and provide patients with a safe and secure way to consult a doctor free of charge.

The organizers highlighted that there was more to be done with regards to inclusion and democratization of these skills and knowledge, as the attendance at the event, as with many tech events in the country, was composed primarily of people from Nairobi, with limited representation from the rest of Kenya.

5.6 IndabaXNamibia

This event was a day of tutorial lectures from Namibians, aligning their Indaba with their research focus areas and local needs. Particularly successful were their practical sessions which were structured to give participants a general view of why machine learning is important as well as examples of its applicability. Students also had a chance to showcase some of their machine learning and natural language processing projects as a precursor to opening up discussions on the challenges, impact and importance of diversity in the fields of machine learning and deep learning.

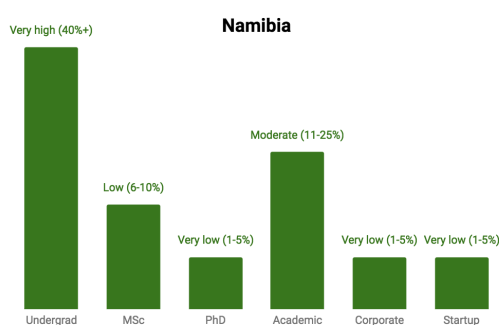


Figure 7: Namibia Participant types

Dr. Nalina Suresh, who facilitated an introduction to deep learning session did a great job of explaining the basic

principles building upon sessions by previous speakers on machine learning. Of the 40 attendees, 36 percent were female. The event fostered collaboration of different stakeholders with speakers from Namibia University of Science and Technology, the National Statistics Agency, and Standard Bank Namibia.

5.7 IndabaXSudan

Facing significant obstacles in accessing services many of us would take for granted, this Indaba was led by two of our 2017 participants, with aims to stimulate the Sudanese community. Their goal was to perpetuate the same spirit of strengthening machine learning through state of the art teaching that embodied the Deep Learning Indaba 2017. The sessions were a combination of lectures as well as practicals and the one day event was concluded with a panel discussion on the general state of machine learning in Sudan.

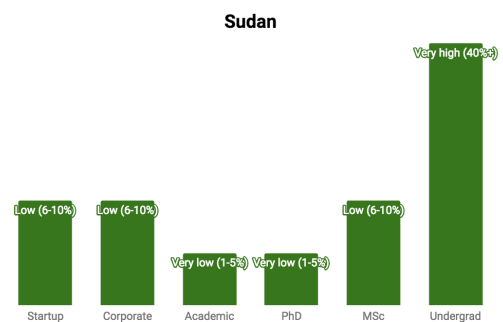


Figure 8: Sudan Participant types

It is encouraging that although the event could only host 100 participants due to budgetary constraints, there was great demand for it as 536 applications were received. The Sudan Ministry of Higher Education came on board as a sponsor. The event had 30 percent female attendees and the most outstanding session covered Convolutional Neural Networks presented by Mustafa Alghali.

5.8 IndabaXSwaziland

This IndabaXSwaziland presented an opportunity for the first meeting of the machine learning community in the Kingdom of Swaziland. With the aim of improving the machine learning research capacity of students and researchers, the one day event featured sessions that introduced participants to the fundamentals of machine learning, deep learning as well as their applications in fields such as Cyber Forensics and Medical Informatics. Dr. Wisdom Dlamini's session titled "Application of Deep Neural Networks for Crop Classification from Satellite Imagery" particularly stood out as informative as well as practical. Overwhelming feedback, in the main organisers' words, suggests that, "We need more time for the demonstration of the application of machine learning/Deep learning techniques to enable us to be able to lay a good foundation for starters and improve the existing knowledge of other participants". 89 participants attended the IndabaX but of these, only 5 percent were women.

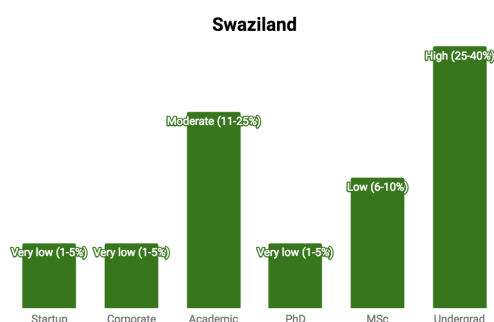


Figure 9: Swaziland Participant types

The Department of Computer Science at the University of Swaziland not only came on board as the main sponsor but also had the faculty organise as well as facilitate most of the sessions.

5.9 IndabaXTanzania

Several organisations come together to host this IndabaX at the Nelson Mandela African Institution of Science and Technology (NMAIST), with a focus on machine learning in health, natural language and time series analysis. The 5-day workshop held at the NMAIST, Arusha campus brought together 51 Masters and PhD students, 19.6 percent of whom were female.

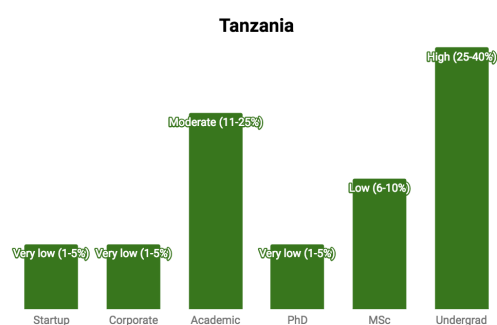


Figure 10: Tanzania Participant types

The IndabaX included a preliminary "day 0" to the workshop where participants were taken through the basics of Python for machine learning and several data science libraries. This greatly contributed to making the event a success by laying a foundation for even absolute beginners. A suggestion was made to have more workshops like the IndabaX, as the need to supplement the university curriculum with regards to AI at most higher learning institutions in Tanzania is apparent.

5.10 IndabaXUganda

A perfect example of community building, the IndabaXUganda was a one day event bringing together 6 universities: Uganda Technology and Management University, Makerere University, Islamic University in Uganda,

Kampala International University, Uganda Christian University, and Busitema University. It brought together researchers, industry and academia with 68 participants, 30 percent of whom were women. The focus was on recent trends and aimed at finding common interests as avenues for collaboration moving forward.

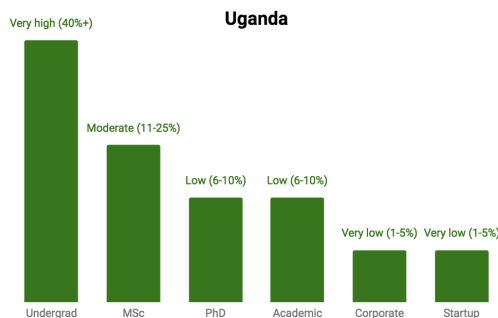


Figure 11: Uganda Participant types

Grouping participants and challenging them to identify a problem that can be solved using machine learning in various fields, such as health, agriculture, governance and education, saw great results by introducing a practical aspect to the agenda. It also served to encourage building solutions to local problems, a topic which Dr. Ernest Mwebaze set the stage for with his talk titled, "Artificial Intelligence in the Developing World."

5.11 IndabaXSouthAfrica

The IndabaXSouthAfrica was designed to be a condensed version of the main Deep Learning Indaba with one-hour presentations including Jupyter notebooks containing practical, real world applications of the techniques learnt.

The event brought together four universities in the Western Cape province

of South Africa. With 205 participants, this was by far the largest IndabaX and 25 percent of attendees were female.

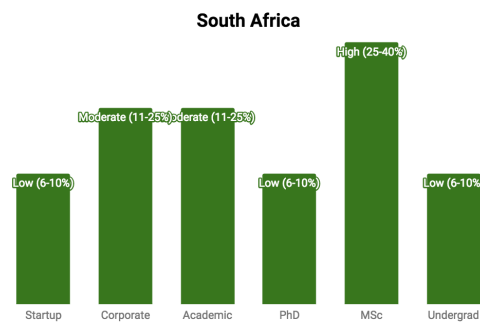


Figure 12: South Africa Participant types

With 15 industry sponsors, including IBM Research, Stone Three Mining Solutions and Aerobotics, and 27 speakers, the event had several tracks to accommodate participants at different levels as well as their varied interests. The three tracks were; the Foundations/Application Stream, the NLP/Vision Stream and the Theory/Bayesian Stream.

A panel discussion that capped the agenda of the day highlighted internships as a means of getting more people interested in data science and machine learning as companies struggle to identify talent and the talent is struggling to gain access to data and work on interesting problems. Stuart Reid's talk, "Deep Learning in Complex Dynamical Systems" was highlighted as world class with outstanding deep learning content. He spoke about the assumption often made by machine learning methods that a data generating process is stationary, meaning that it doesn't change over time, and how to handle these nonstationary situations.





5.12 IndabaXZimbabwe

The IndabaXZimbabwe considered the needs of AI and ML in three parallel streams: in academia, in business, and in policy-making. It brought together stakeholders from each sector for the purpose of sparking discussion around a possible national plan towards developments in AI and ML. The variety in the agenda of the day reflected the interests of different stakeholders. Particularly successful were the practical sessions which were oversubscribed as well as the roundtable whose speakers had a great understanding of the topic and kept the audience well engaged. Overall the event had 100 participants, 30 percent of whom were women.

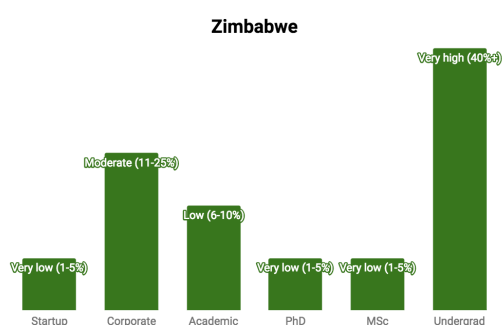


Figure 13: Zimbabwe Participant types

In addition to the University of Zimbabwe, who hosted the IndabaX, other sponsors included Liquid Telecom and TelOne who had speakers lead sessions and take part in the discussions. Mr. Martin Mushambadope who spoke about the Big Data Analytics Platform used by Liquid Telecom and its partners did a particularly good job. Based on the discussion, one highlighted outcome of this forum was a step towards building a proper understanding by all stakeholders involved of the importance and impact of AI and ML to various aspects of business operations as well as socio-economic aspects and how it can be best

leveraged. Moving forward, more training to expose students and researchers was suggested.

5.13 IndabaXZambia

In partnership with Agora code community, the IndabaXZambia was a one day machine learning bootcamp aimed at building ML capacity among the next generation of Zambian youth. Organisations such as Python Software Foundation and Zambia National Data Centre came on board as cash sponsors while the NVIDIA Deep Learning Institute provided token codes redeemable for their services. Dr. Aboubadya Shabat from the Durban University of Technology facilitated an introductory session on machine learning which contributed directly towards one of the main event outcomes, increasing the understanding and appreciation of machine learning among students. 60 students attended the IndabaX, but only 8 percent were women.

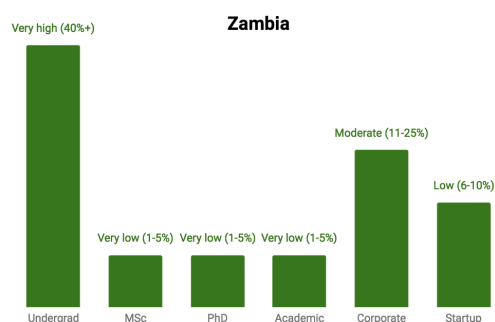


Figure 14: Zambia Participant types

Based on the discussion, interesting avenues suggested to further improve machine learning in Africa include encouraging exchange programs between countries to increase exposure, as well as a need to start implementing what has been learnt to solve existing socio-economic problems in the country.



6. Ongoing Challenges

There are many challenges that remain, especially as we seek to create and support strong local leadership in machine learning and artificial intelligence across our continent. The first principle of the IndabaX, and which remains our approach, will be to continue seeking out as many grassroots organisations, meetup-communities, university groups, hubs, and other collectives, with interests or working in these areas. We believe that partnering with these groups, supporting them in all the ways that they might need, and challenging them to do more to create strong communities, is the principle that will both lead to increased ownership of the advances in AI, and how we will create a united continental community.

Grant sizes. Every IndabaX event wished they had more funds. The lack of funds curtailed their ambition in two specific dimensions: in the number of attendees and the length of their events. Almost all expressed the willingness to organise multi-day events and to at least double the number of participants they had. Yet despite this challenge, **the 13 IndabaX events collectively included over 1000 people in the ongoing advances in AI**, and with a passion that is indicative of the future culture of the African AI community, and evident in the fact that all the organisers expressed the wish to organise an IndabaX again.

Participation of women. As the representation statistics in figure 1 showed, the representation of women in each of these events is one where much more emphasis must be placed. We will ensure that more ongoing feedback is

given during the planning process of each IndabaX event. This also requires more direct intervention, and at the level of the Indaba Organisation, we will seek to address this by creating new programmes related to strengthening African Women in Machine Learning, that will be launched separately.

Speaker introductions. Access to speakers is a second area every event wished to improve. For those events that were able to access more international or high-profile speakers, they reported a higher level of excitement and engagement. The inclusion of a wider set of speakers would seem to increase the value-proposition offered by the IndabaX events. This inclusion will need to be balanced against the goal of creating visibility for current and future local leaders. Access to a wider set of speakers is something we are well placed to do as the Indaba Organisation, and will improve going forward. Offering strong suggestions for experts from various countries will create a new mechanism for knowledge exchange between countries and regions.

Language inclusion. The inclusion of different language groups continues to be part of our ongoing effort. For 2018, the only IndabaX event in a country in which French is the common language of communication was in Cameroon, host of the IndabaXCentrafrique. This is partly due to our limited reach at present in these regions, which we continue to address. We will address this by seeking out more partners in these regions and using the interest from attendees of the

annual Indaba to engage with a wider set of countries.

Long-term funding. The principle challenge facing the Indaba organisation is the mechanism by which the IndabaX is funded. The work of fundraising continues to be our major effort. We constantly seek new funders who

understand the critical need to strengthen African machine learning and will financially enable us to support the IndabaX programmes. This ongoing need points to other parts of the Indaba Organisation's ongoing work to strengthen partnerships with universities, governments and local industries.

7. The Future

The IndabaX has been amongst the most impactful work we have done: no longer can there be said that there is no machine learning or artificial intelligence in Africa. We have clear evidence from 13 different countries, and more than a thousand people, together building their local leadership and communities and visions for an African technology of the future.

It matters greatly that there is now a strong community in Sudan or Swaziland where there was previously none; that 6 different groups in Uganda had come together to create the IndabaX meeting; that we are able to form stronger ties with the community of Women in Machine Learning and Data Science in Kenya; and that the strong machine learning community in South Africa that we played a role in initially strengthening is strengthened further. The recommendations of this report now become the foundation of our strategy for the IndabaX going forward.

**Our work in creating pan-African leadership in AI has just begun.
Creating ubiquitous leadership is clearly possible.**

Appendix A: List of IndabaX2018 Organisers

Algeria

Mostafa El Habib Daho (University of Tlemcen)

Botswana

George Anderson (University of Botswana)
Tallman Nkgau (University of Botswana)

Cameroon

Roy Henha Eyono (University of the Witwatersrand)
Basiliyos Betru (Ecole National Supérieure Polytechnique de Yaoundé)
Patrice Okouma (University of Cape Town)
Julien Nyambal (University of the Witwatersrand)

Kenya

Kathleen Siminyu (Africa's Talking)

Lesotho

Mathe Ntsekhe (National University of Lesotho)

Namibia

José G. Quenum (Namibia University of Science and Technology)
Annastasia Shipepe (University of Namibia)

South Africa

Kayode Olaleye (African Institute for Mathematical Sciences)
Lydia de Lange (Stellenbosch University)
Musa Salmamza (University of Cape Town)
Alex Conway (NumberBoost)

Sudan

Abdallah Mohammed (University of Khartoum)

Swaziland

S. G. Fashoto (University of Swaziland)

Tanzania

Anthony Faustine (Pythontz)

Uganda

Bruno Ssekiwere (Uganda Technology and Management University)
Claire Babirye (Uganda Technology and Management University)

Zambia

Yasin Ayami (TsogoloTech)

Zimbabwe

Gilford Hapanyengwi (University of Zimbabwe)

Appendix B: List of Indaba Organisers and Advisory Board

Indaba Abantu

- Shakir Mohamed, Staff Research Scientist, DeepMind
- Ulrich Paquet, Staff Research Scientist, DeepMind
- Vukosi Marivate, Senior Researcher, Council for Scientific and Industrial Research
- Willie Brink, Senior Lecturer, Stellenbosch University
- Nyalleng Moorosi, Senior Researcher, Council for Scientific and Industrial Research
- Stephan Gouws, Research Scientist, Google
- Benjamin Rosman, Principal Researcher, Council for Scientific and Industrial Research (CSIR), and Senior Lecturer, University of the Witwatersrand
- Richard Klein, Associate Lecturer, University of the Witwatersrand
- Avishkar Bhoopchand, DeepMind
- Kathleen Siminyu, Africa's Talking
- Muthoni Wanyoike, Code for Africa
- Daniela Massicetti, University of Oxford
- Herman Kamper, Stellenbosch University

Advisory Board

- Bitange Ndemo, Univ of Nairobi, Safaricom, Former Permanent Secretary
- Bubacarr Bah, Research Chair, African Institute for Mathematical Sciences
- Bonolo Mathibela
- Danielle Belgrave, Microsoft Research Cambridge, Imperial College
- George Konidaris, Assistant Professor, Brown University
- Joy Buolamwini, MIT and Algorithmic Justice League
- Nando de Freitas, Senior Staff Research Scientist, DeepMind
- Rachel Thomas, Fast.ai co-founder, Univ San Francisco